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SYSTEMATIC USE OF P.G. 600® ON PRIMIPAROUS SOWS ON A WELL MANAGED FARM

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P.G. 600® is often used as an estrus promoter on sows with controversial results. This experiment was carried on a well managed farm with 2,500 sows during one calendar year. Half of primiparous sows, 502 of a total of 1005, were treated with P.G. 600® at weaning. Three week observation time formed one batch of data with an adequate number of observations for statistical evaluation. Every batch was evaluated separately. Moderate improvement of reproduction traits was found in the experimental group. Both, the percentage of sows in estrus after weaning (95.98 % versus 94.99 %) and the percentage of sows farrowing the second litter (90.34 % versus 88.38 %) was higher in the experimental than in the control group. Experimental group had a slightly larger litter (14.22 versus 13.85), shorter period to first estrus (6.16 days versus 7.10 days) and shorter period to successful insemination (8.10 days versus 8.56 days). Improvement of fertility traits was observed particularly in late winter, spring and early summer, but it was not confirmed by statistical evaluation. Unexplained variance in the statistical model was high. The use of P.G. 600® in well managed heards in Slovenian moderate climatic conditions is unnecessary. That conclusion cannot be generalised for other managements and climatic conditions.

Key words: primiparous sows, fertility traits, P.G. 600®, seasonal fertility

INTRODUCTION

Several methods are available for porcine estrus synchronization. Besides proper management of sows during lactation and at weaning, gonadotropin treatment in sows at weaning is also useful to prevent delayed return to estrus associated with season and parity. Orally active progestogen and P.G. 600® (Intervet – Schering Plough Animal Health) are used for inducing precocious puberty and fertile estrus in gilts and sows (Estienne *et al*., 2002; Fernandez *et al.,* 2005; Horsley *et al.,* 2005). The ability to control the time of estrus in cyclic females facilitates the introduction of gilts into the breeding herd, as well as rebreeding of sows after weaning (Stančić *et al*., 2009).

One dose of P.G. 600® contains 400 IU serum gonadotropin (PMSG) and 200 IU chorionic gonadotropin (HCG). Effect of altering dose of P.G. 600® was tested in order to determine the reproductive performance response in gilts and weaned sows (Breen *et al.,* 2006). Gonadotropin treatment of early weaned sows is recommended to overcome negative effects of early weaning on reproductive performance, particularly weaning to estrus interval, reduced first service conception rates and fewer live embrios (Marbry *et al.,* 1996; Marsteller *et al.,*1997). Primiparous sows treated at weaning with P.G. 600® had a shorter and more synchronous weaning to estrus interval compared to untreated sows (Kirkwood *et al.,* 1998).

Sows exhibit a seasonal breeding pattern that is characterized by a 20 – 30% decrease in the rate of early return to post weaning estrus from June to October compared with the remaining months of the year (Hurtgen and Leman, 1979; Te Brake, 1978). Prolonged weaning to estrus interval and persistent anestrus may occur when litters are weaned during the summer months (Hurtgen *et al.,*1980; Britt *et al.*,1983). Treatment with P.G. 600® would induce fertile estrus in summer weaned sows 3 to 5 days following injection (Hurtgen and Leman, 1979, Webster, 1978). In sows whose litters were weaned in the summer and early fall after a 3 to 4 week lactation, treatment with P.G. 600® at weaning significantly reduced days to postweaning estrus in first and second parity sows and postweaning anestrus in primiparous sows (Bates *et al.,* 1991). Tratment of sows weaned in the summer months with this peparation virtually eliminates the problem of seasonal anestrus (Hurtgen and Leman, 1979). Reproductive performance in first litter gilts and sows after weaning may be improved over the expected value with P.G. 600® (Kirkwood *et al.,* 1998).

MATERIAL AND METHODS

The experiment was done on a weaner production farm with approximately 2,500 sows. The farm is well managed and highly productive. According to internal data during the year 2009 sows produced on average 14.04 liveborn piglets per litter and the farrowing rate was 89.4 %. The herd consisted of hybrid sows, crossbreds of Landrace females and Large white boars. Sows were inseminated with mixed semen out of five or six ejaculates of different Duroc boars. The heard was managed in a so-called week production cycle – piglets were weaned on Wednesdays. The consequence is that most animals expressed estrus on Mondays. Sows were fed *ad libitum* during lactation with feed mixture for lactating sows containing 16.5 % crude proteins, 11 g per kg feed lysine and 13.5 MJ of metabolic energy. Every Wednesday morning (weaning day) sows were fed with approximately 3.5 kg feed. Then the sows starved until Friday morning (approximately 36 hours). On Fridays and Saturdays animals were flushed with 4 kg of feed mixture for lactating/gestating sows which contains 14% CP, 7 g Lys per kg feed and 12.0 MJ ME. The same feed was offered on Sundays and Mondays, but animals in the first phase of estrus consumed less feed - approximately 2 kg.

All primiparous sows weaned between January 28th 2009 and January 27 th 2010 participated in the experiment. Half of animals were randomly chosen every week and treated with a dose of 5 mL P.G. 600® just after weaning. One dose of P.G. 600® contains 400 IU serum gonadotropin (PMSG) and 200 IU chorionic gonadotropin (HCG). The control group was not treated with any hormone or other estrus stimulans.

The primary goal of the experiment was to investigate the effect of P.G. 600® administration through the whole year and inside the seasons of the year for the productivity of primiparous sows. The number of investigations per week was low and therefore inappropriate for statistical evaluation. This restriction was overcame with a combination of three week observations in one batch. The variables, weaning to insemination interval (WI), weaning to successful insemination interval (WSI) and the size of second litter (LS) for every single data batch were studied with the following statistical model:

$$Y_{ij} = \mu + Pi + b_1(S_{ij} - \overline{S}) + b_2 (A_{ij} - \overline{A}) + e_{ij}$$

The Y_{ij} is the observation of the studied trait, μ is the average of the statistical model, P_i is the effect of administration of P.G. 600®. The $b_1(S_{ij}–\overline{S})$ represents a linear regression of litter size of first farrowing on the studied trait and $b_2(A_{ij} - \overline{A})$ represents linear regression of age at first farrowing on the studied trait. The basic statistics was done with SAS/BASE procedure. Other statistical evaluations were done with STAT/GLM procedure.

RESULTS AND DISCUSSION

Observed number of second farrowing was 1 005 (503 in the control and 502 in the experimental P.G. 600® group). The obtained results for variables, used in the statistical model are presented in Table 1.

Table 1. Percentage of sows in estrus, percentage of sows farrowing second litter, and the average and standard deviation for the age at first farrowing, litter size at first farrowing, litter size (LS), weaning to first insemination (WI) and weaning to successful insemination (WSI)

	Control	P.G. 600®
Sows in estrus / weaned sows (%)	94.99	95.98
Sows 2nd farrowing/ weaned sows (%)	88.38	90.34
Age at 1st farrowing (days)	358.38±9.59	358.73±9.65
Litter size at 1st farrowing	12.85±2.47	12.73±2.58
LS (piglets)	13.98±2.97	14.22±3.13
WI -days	7.10±5.97	6.16±4.42
WSI - days	8.56±9.4	8.10±8.19

The production results in both groups were excellent. Both groups started the experiment with equal performances. The age at first farrowing (control group

358.38 versus 358.73 days in the experimental group) and first litter size (control group 12.85 and experimental group 12.73 liveborn piglets per litter) were very close. The production of both groups in experiment did not differ very much. The experimental group showed smaller LS (14.22 compared to 13.98 live piglets born per litter), shorter WI (6.16 compared to 7.10 days) and sorter WSI (8.10 compared to 8.56 days) than control group. Both periods, WI and WSI, showed large variability, but standard deviation was smaller in experimental compared to control group. The percentage of sows in the first estrus and percentage of pregnant sows was, as expected, little higher in the experimental group compared to the control group.

The differences between groups in one year period are very small. The seasonal effect of P.G. 600® administration is at least as important as an effect during the whole year. In the Figure 1 the percentage of sows in estrus and in Figure 2 the percentage of sows farrowing second litter are presented. In both cases is the divisor the number of sows weaned after first litter and selected for next reproduction cycle.

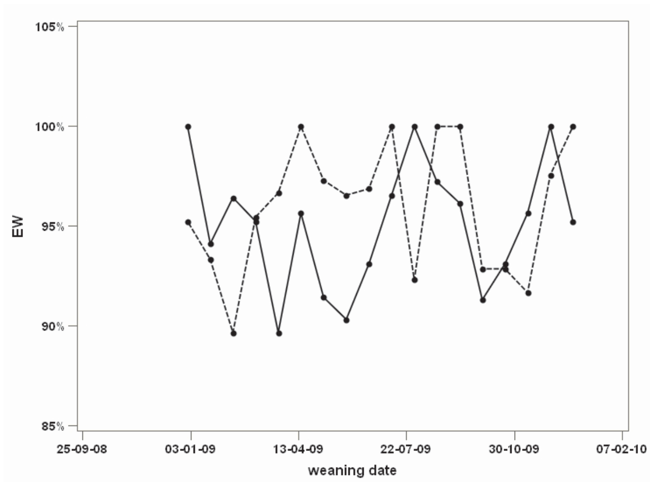

Figure 1. The percentage of sows in estrus (number of sows in estrus/number of sows weaned (100, EW). Dashed line represents P.G. 600® group

Both figures showed an effect of P.G. 600® administration during the late winter, spring and early summer. Approximately five percent more treated than untreated animals came in estrus during that period. The difference in the farrowing rate between both groups was even larger. During late summer, autumn and most of the winter differences between groups were not observed. In other studies much larger differences were observed. During the summer and fall after the first parity there were 15.6 % treated sows in anestrus compared to 29.2 % untreated sows (Bates *et al*., 1991). In a study (Knox *et al*., 2001) 94.4% animals expressed estrus in P.G. 600® group compared to 78.4% in control group. In the experiment by Estienne and Hartsock (1997) 97.1% treated sows expressed estrus compared to 82.9% untreated animals. The rate of pregnancy in this study was 82.3% in P.G. 600® group compared to 82.9% in the control group. Compared with the results of Bates *et al*. (1991) and Knox *et al*. (2001) our results were improved. Estienne and Hartsock (1997) found a higher rate of animals in estrus, but the rate of pregnancy was low and not better compared to the control group. It seems that the administration of P.G. 600® did not increase estrus and pregnancy rate in herds with good management with an exception of the period between the end of the winter and beginning of the summer.

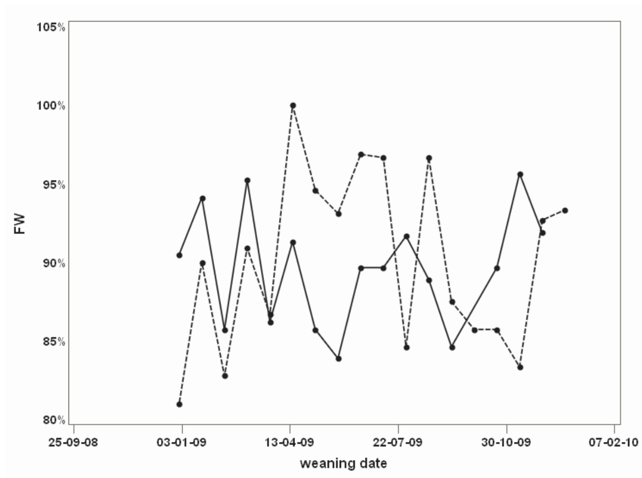

Figure 2. The percentage of sows farrowed second litter (number of sows farrowed second litter/number of sows weaned *100, FW). Dashed line represents P.G. 600® group

In the Table 2 the results of analysis of variance according to model <1> for WI, regression coefficients for effects treatment and age and LSM values for effect treatment are presented.

The assumed statistical model <1> did not explain WI in any experimental period. The only period where the model almost explains the variability was the period 12 in the middle of August (P = 0.0578). The variability in the model was explained with effects of litter size in the previous litter and not with the treatment with P.G. 600®. Animals from the season with larger litter size in the first litter produced less piglets in the second litter (b = -0.9420). LSM values for WI are presented in Figure 3. Because of the insignificance of the model (p>0.05) at all periods, LSM values for WI have only informative character. The WI values were statistically not significantly (p>0.05) longer in the control group. An exception was late summer and early autumn. The reduction of weaning to estrus period after administration of P.G. 600® was found also in other studies – 5.3 versus 8.0 days (Vargas *et al.*, 2006), 3.8 versus 4.9 days (Knox *et al*., 2001) and 3.8 versus 4.5 days (Estieene and Hartsock, 1998). The differences between groups in previous studies were statistically significant ($p<0.05$). It seems that some nonregistered effects influenced WI. Those effects covered the true effect of P.G. 600®.

Table 2. Results of analysis of variance according to model <1> for WI

	Average date	Model		Effects (Prob.)			Regression coef.		LSM	
		F	P	treat.	lit. size	age	lit. size	age	cont.	PG.
1	31 December	0.11	0.9522	0.671	0.733	0.946	-0.3620	0.0250	6.33	8.80
2	21 January	1.45	0.2390	0.191	0.278	0.435	0.3270	0.1090	6.63	7.57
3	11 February	1.20	0.3212	0.069	0.654	0.452	-0.3310	0.1440	8.22	5.23
4	04 March	0.75	0.5269	0.848	0.805	0.162	-0.0870	0.1480	7.95	6.10
5	25 March	0.20	0.8939	0.457	0.828	0.789	-0.1130	-0.0350	7.23	6.41
6	15 April	0.69	0.5639	0.385	0.305	0.521	0.4510	0.0990	5.59	5.95
7	06 May	1.29	0.2870	0.108	0.911	0.305	-0.0550	-0.1190	8.66	5.58
8	27 May	0.72	0.5444	0.287	0.908	0.314	0.0590	0.1290	7.04	6.46
9	17 June	1.07	0.3707	0.464	0.204	0.655	-0.4820	0.0460	7.41	6.29
10	08 July	0.44	0.7273	0.879	0.409	0.392	0.5450	-0.1550	7.89	5.70
11	29 July	0.16	0.9201	0.716	0.579	0.954	0.2620	0.0090	7.25	5.33
12	19 August	2.63	0.0578	0.661	0.015	0.408	-0.9420	0.0740	5.83	6.93
13	09 September	2.00	0.1282	0.530	0.048	0.178	-1.1440	-0.2080	7.20	6.21
14	30 September	0.89	0.4546	0.238	0.456	0.635	-0.1460	-0.0240	6.19	5.04
15	21 October	0.33	0.8027	0.638	0.458	0.584	-0.2750	-0.0770	5.22	6.46
16	11 November	0.64	0.5942	0.322	0.453	0.545	0.2320	-0.0440	5.77	6.36
17	02 December	0.03	0.9914	0.765	0.911	0.973	0.0560	-0.0050	9.68	5.53
18	23 December	0.23	0.8761	0.460	0.758	0.944	-0.2530	0.0220	6.45	6.00

In Table 3 the results of analysis of variance for WSI are presented according to the model <1>.

The assumed statistical model <1> explained WSI ($p<0.05$) only in two observed periods (12 in the middle of August) and in 17 (at the end of November and beginning of December). In the second case the WSI was influenced by treatment. The model nearly explained variability in period 3 at the beginning of February. In that season the treatment with P.G. 600® had the most important effect. The WSI in the treated group was in period 3 shorter as in the control group (13.26 versus 7.58 days). The same variable was in the season 12 surprisingly shorter in the control group – 7.06 versus 8.43 days. The data batches were still relatively small. Only a low number of unexpected results concentrated in one group induced by some cause, which was not considered in the model, can produce such an unexpected result.

Table 3. Results of analysis of variance for WSI according to model <1>

	Average date	Model		Effects (Prob.)			Regression coef.		LSM	
		F	P	treat.	lit. size	age	lit. size	age	cont.	PG.
1	31 December	0.69	0.5631	0.198	0.911	0.530	0.0541	-0.1056	10.14	12.1
2	21 January	1.34	0.2710	0.601	0.259	0.201	0.2917	0.1544	6.63	9.04
3	11 February	2.70	0.0557	0.020	0.489	0.050	-0.2316	0.1730	13.26	7.58
4	04 March	0.48	0.7005	0.332	0.851	0.711	-0.0581	0.0341	7.95	7.1
5	25 March	0.41	0.7451	0.683	0.377	0.660	-0.3152	0.0392	9.12	7.24
6	15 April	0.24	0.8664	0.697	0.445	0.902	0.1822	-0.0103	6.55	8.1
7	06 May	1.48	0.2278	0.059	0.734	0.714	-0.1000	-0.0252	11.31	7.11
8	27 May	1.43	0.2437	0.634	0.221	0.241	0.4179	0.0998	9.32	7.14
9	17 June	1.37	0.2607	0.222	0.069	0.895	-0.4922	-0.0097	7.41	9.55
10	08 July	2.61	0.0604	0.256	0.139	0.119	-0.4701	-0.1360	9.89	10.37
11	29 July	0.99	0.4063	0.145	0.395	0.925	0.2674	0.0099	7.25	8
12	19 August	3.09	0.0335	0.501	0.010	0.371	-0.5882	0.0474	7.06	8.43
13	09 September	1.79	0.1622	0.896	0.066	0.244	-0.6023	-0.1020	8.92	9.17
14	30 September	0.89	0.4546	0.238	0.456	0.635	-0.1463	-0.0238	6.19	5.04
15	21 October	1.56	0.2100	0.481	0.081	0.914	-0.3157	0.0073	7.00	6.46
16	11 November	1.08	0.3668	0.573	0.095	0.929	0.3958	-0.0049	5.77	7.36
17	02 December	2.78	0.0473	0.008	0.531	0.586	-0.2012	0.0542	9.68	8.98
18	23 December	0.11	0.9522	0.752	0.641	0.939	-0.1548	0.0097	10.15	7.33

In Table 4 the results of analysis of variance according to model <1> for LS, regression coefficients for effects treatment and age and LSM values for effect treatment are presented.

Statistical model <1> explained variance ($p<0.05$) in periods 1, 2, 4, 6, 7, 8, 12, 13, 15, 16, and 17. The periods were distributed during the whole year. Although the average litter size in the second parity was larger in the treated group than in the control group (Table 1), the difference between the groups was not significant ($p<0.05$). The most important source of variability was the litter size in first parity. The effect showed significant effect on litter size in all seasons with a significant explanation of variability with model<1>. The only exception was period 13. The regression coefficients were all positive. Animals with larger litter size in the first parity produced more piglets in the second parity independent to the treatment with P.G. 600®. In two cases litter size depended also on the age of the animals at the first farrowing. The same result – no effect of P.G. 600® upon litter size was found also in other studies (Breen *et al*., 2006; De Rensis *et al*., 2003; Knox *et al*.,2001; Estiene and Hartsock, 1997). On the contrary, in the study

(Vargas *et al*., 2006) an effect of treatment with P.G. 600® on litter size was found. Treatment resulted with a larger litter size - 11.2 versus 10.4.

Table 4. Results of analysis of variance for LS according to model <1>

	Average date	Model		Effects (Prob.)			Regression coef.		LSM	
		F	P	treat.	lit. size	age	lit. size	age	cont.	PG.
1	31 December	4.32	0.0115	0.397	0.002	1.000	0.8843	0.0000	14.53	13.53
2	21 January	2.82	0.0475	0.422	0.012	0.245	0.2997	-0.0645	14.63	15.33
3	11 February	2.64	0.0611	0.114	0.036	0.772	0.5912	0.0166	13.21	14.96
4	04 March	4.89	0.0059	0.486	0.001	0.253	0.7432	0.0719	13.75	13.70
5	25 March	1.75	0.1705	0.640	0.052	0.406	0.2563	-0.0285	13.60	14.00
6	15 April	4.09	0.0130	0.227	0.003	0.622	0.4039	0.0233	14.95	14.10
7	06 May	10.02	0.0000	0.193	0.000	0.125	0.6902	-0.0517	13.43	15.14
8	27 May	3.77	0.0163	0.743	0.008	0.314	0.4251	0.0382	13.92	13.70
9	17 June	2.10	0.1118	0.610	0.022	0.303	0.3182	0.0386	13.31	13.32
10	08 July	0.57	0.6365	0.238	0.705	0.938	0.0771	-0.0044	12.38	13.55
11	29 July	1.66	0.1908	0.145	0.262	0.177	0.2294	-0.0846	13.86	15.09
12	19 August	3.27	0.0277	0.626	0.003	0.451	0.4770	0.0284	14.38	14.03
13	09 September	3.13	0.0363	0.321	0.215	0.045	0.2275	-0.1025	13.95	15.52
14	30 September	0.46	0.7085	0.979	0.457	0.314	0.1416	-0.0478	14.28	13.96
15	21 October	4.55	0.0071	0.460	0.004	0.106	0.4063	-0.0839	14.62	13.42
16	11 November	9.38	0.0001	0.716	0.000	0.417	0.6217	-0.0236	14.09	13.80
17	02 December	5.63	0.0017	0.967	0.009	0.006	0.4227	-0.1333	14.38	14.26
18	23 December	2.81	0.0592	0.941	0.008	0.901	0.6238	0.0115	14.63	14.43

Treated groups showed slightly increased average performances in all studied traits. The administration of P.G. 600® had stronger influence both on estrus incidence as on pregnancy. Improvement as a consequence of P.G. 600® administration was very moderate and was not detected with the statistic model, used in this study. Fertility of female animals is influenced by many causes. Most of them were not registered and were later on included in statistical models. The consequence is an increased error of the rest of variance (e_{ij} in this model) and nonsignificance ($p>0.05$) of treatment with P.G. 600®. Reproduction results in this herd were good in both groups. It can be concluded that in herds with a good management as in this herd the treatment with P.G. 600® is unnecessary.

CONCLUSIONS

The commercial P.G. 600® was used as estrus promoter on primiparous sows on a weaner production farm with 2,500 sows during the whole year.

Primiparous sows were treated at weaning with 5 mL P.G. 600® (Intervet Schering Plough Animal Health). Data from three calendar weeks were collected in one batch. Every batch was separately statistically evaluated. Both, the percentage of sows (95.98 % versus 94.99 %) and the percentage of sows farrowing the second litter (90.34 % versus 88.38 %) was higher in P.G. 600® than in the control group. Slightly larger litter size in experimental group (14.22 versus 13.85), shorter period to first estrus (6.16 days versus 7.10 days) and shorter period to successful insemination (8.10 days versus 8.56 days) were found. The moderate improvement of reproduction traits of treated animals was observed particularly in late winter, spring and early summer. Observed trends of improvements in the treated group were not statistically significant because of high variance. Moderate, but statistically insignificant ($p>0.05$) improvement of fertility traits in well managed herd in Slovenian climate did not justify the use of P.G. 600®. This conclusion is valid for this special case. A one year period with other weather conditions on the same production site or different management on the same farm may lead to other conclusions.

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SISTEMSKA PRIMENA PREPARATA P.G. 600® KOD PRVOPRASKINJA NA FARMI SA DOBRIM MENADŽMENTOM

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SADRŽAJ

Za izazivanje estrusa kod krmača sa problematičnim reproduktivnim rezultatima često se koristi P.G. 600®. Ova ispitivanja su obavljena na farmi sa dobrim menadžmentom sa 2500 krmača u toku jedne kalendarske godine. Polovina prvopraskinja (502 od 1005) su tretirane sa P.G. 600® na dan zalučenja prasadi. U toku perioda posmatranja od tri nedelje, formirana je serija podataka sa adekvatnim brojem zapažanja za statističku procenu. Svaka serija podataka je procenjivana odvojeno. Utvrđeno je umereno poboljšanje reproduktivnih parametara u eksperimentalnoj grupi. Procenat krmača u estrusu posle zalučenja (95,98% u odnosu na 94,99%) i procenat krmača posle drugog prašenja (90,34% u odnosu na 88,38%) su bili viši u eksperimentalnoj grupi nego u kontrolnoj. Ogledna grupa je imala nešto veće leglo (14,22 u odnosu na 13,85), kraći vremenski period do prvog estrusa (6,16 dana u odnosu na 7,10 dana) i kraći vremenski period uspešne inseminacije (8,10 dana u odnosu na 8,56 dana). Poboljšanje plodnosti je zapaženo posebno krajem zime, u toku proleća i početkom leta, ali uočene razlike nisu bile statistički značajne. Upotreba P.G. 600® u stadima dobrim menadžmentom i u slovenačkim umerenim klimatskim uslovima nije se pokazala opravdanom. Ovaj nalaz se ipak ne može generalizovati na druge klimatske uslove i druge tipove menadžmenta.